approach

SEPTEMBER 1980 THE NAVAL AVIATION SAFETY REVIEW

They're Not Just Numbers!

WHEN people talk aviation safety, they inevitably include numbers in their discussion. Major aircraft accident rates, numbers of incidents, numbers of destroyed aircraft, percentages of human error, and numbers of ground mishaps are some of the more popular figures used in aviation safety analyses, discussions, and articles. While the use of these and other numbers is essential in conducting trend analyses and various statistical studies, their full meaning often seems to get lost in the process.

A good example of a number that really means something is this year's number of fatalities as a result of major aircraft accidents. The number is 64, as of 19 July 1980. Last year's number for the same period was 32. As you can clearly see, the number has doubled. But these numbers are not obtuse rates or percentages generated by the Naval Safety Center computer; they are numbers of dead people – dead, irreplaceable shipmates of yours and mine. They were husbands, fathers, sons, friends, and coworkers, as well as naval flightcrew personnel. Their loss affected not only the manning level of their squadrons, the overall readiness of naval aviation, and the number of replacement pilots, NFOs, and aircrewmen required from the training command next year, but also the morale of their squadronmates, the lives of their families, their neighborhoods, the churches and civic organizations to which they belonged, and so on. They were 64 multifaceted, unique, and valuable human beings.

These 64 fatalities are also a fairly representative group of naval aviation personnel. Many of them were young or sort-of-young junior officers and petty officers, but quite a few were older, extremely experienced individuals. Some of these gents were weak aviators, but most of them were average to well above average. Basically, they were us. They lived, flew, worked, and put their pants on the same way you and I do.

As you read the articles in this magazine or look at the next copy of WEEKLY SUMMARY, don't just look at the way the numbers change or how your numbers stack up against the other guy's numbers – think about what those numbers really mean. As you walk out to man your aircraft on your next flight, think about the fact that 64 people have died this year in naval aircraft accidents. Think about the fact that the majority of these people contributed to their own demise. And think about the fact that it could happen to you.

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APPROACH artist Blake Rader painted the A-7 Corsair at the end of a CCA on this month's cover.

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the ground mishap

a costly experience!

GROUND mishaps in naval aviation are costing millions of dollars and injuring essential personnel. Consider the following incidents involving naval aircraft:

- Following a high power turnup, a CH-53 taxied into a poorly marked ramp area, with accompanying poor weather, at dusk. Its main and tail rotors struck a concrete telephone pole. Six main blades and two tail blades were destroyed at a cost of $75,000 and 40 man-hours in repairs.
- The deck department personnel on an LPH discharged TAU hoses overboard, into the wind. The chemical blew back and dispensed a heavy cloud of PKP throughout the hangar deck and neatly dusted no less than 19 helos. It took cleanup personnel 800 man-hours and about $12,000 to ready the helos for flight.
- The TA-4 had repeated airspeed indicator gripes. Instead of waiting for the qualified supervisor to arrive, two mechs decided to expedite things and "blow out" the pitot-static lines with a walkaround nitrogen bottle. They ruptured a line that cost over $3000 and 4 man-hours to replace.
- Then there was the case of the S-3 being respotted on the CV. A slippery deck and hasty crew allowed the S-3 to slide into an A-7 that was 8 feet away. Two thousand dollars and 4 man-hours later, the S-3's port elevator was repaired. The A-7 got away unscathed.
- Or take the incident where three maintenance stands were inadequately stowed for the present environmental conditions (thunderstorms). They were blown from the GSE parking area into a line of P-3s. Three props had to be replaced, and minor repairs to aircraft skin and GSE had to be accomplished prior to all being returned to an "up" status. A total of 60 man-hours were spent on repairs. The total cost of the props alone was approximately $110,000!

The list goes on! Incidents of this nature went on a *reported* 3244 times and cost the Navy about $110 million and approximately 150,000 man-hours during the 5-year period of 1975-1979 (calendar years). Staggering statistics, aren't they? And these are only the *reported* ground mishaps!

In this 5-year span, naval aviation has averaged over 600 ground mishaps per year. And each year, less 1976, the numbers steadily increased from 481 in '75 to 860 in '79. Whether the increase was due to more mishaps or more accurate reporting (or a combination) remains to be seen. In any case, they increased – and at a steady rate. Not a very good picture as far as naval aviation safety is concerned.

There have been many statistics written and published about naval aviation's major aircraft accident rate, the cost of accidents, and the number of fatalities incurred. Naval Safety Center's WEEKLY SUMMARY keeps us up to date on major accidents on a weekly basis, but a pure accident rate on ground mishaps does not exist. NAVSAFECEN does, however, keep a running tally of all *reported* ground mishaps in "A" (Strike), "C" (Substantial), "D" (Minor), "E" (Limited), and "F" (No damage) categories. These data may be real eye-openers to those that haven't kept up with the pace of these ground mishaps. If those in positions of responsibility are taken aback at some of the statistics that this article unveils, maybe they ought to get together with their safety department personnel and see how their unit stacks up with the overall fleet record for the past 5 years. The following information is an overview thats purpose is to bring to the surface the growing impact ground mishaps have on our fleet readiness. Add this to the cost of major accidents and you can see why aviation is an expensive means of defense.

What were the factors that caused these 3244 ground mishaps? Primarily – *human error.* This one factor was a contributing cause of 83 percent of the total reported ground mishaps from '75-'79. About 12 percent were attributed to *material/design* and the rest to *other* causal factors. *Human error,* as it has taken the largest piece of the percentage pie, is further broken down into categories of personnel. The numbers below total up to over 100 percent due to more than one causal factor being assigned to the same mishap, e.g., mishaps involving supervisory personnel may also have involved support personnel. With this in mind, *human error* is broken down into the following categories:

- Support Personnel . . . . 1289 mishaps or 48 percent
- Maintenance Personnel . . . . 1185 mishaps or 44 percent
- Supervisory Personnel. . . . . 1184 mishaps or 44 percent
- Controlling Personnel . . . . . 456 mishaps or 17 percent
- Pilot Personnel . . . . 39 mishaps or 1 percent
- Miscellaneous Personnel . . . 171 mishaps or 6 percent

Continued

A further breakdown of the mishaps that occurred over the 5-year period are the figures reflecting *afloat* and *ashore* mishaps. Although there is no totally satisfactory way to compare *ship* and *shore* activities, it is significant to note that only about one-third of the ground mishaps occurred aboard ship (997) as compared to ashore (2247). Granted, there are more flight-hours flown from shore stations, but the quarters are not as close nor the conditions as demanding as aboard ship. The ratio is not intended to favor or disfavor either environment. The fact is that it's costly under either circumstance. Looking at "A," "C," and "D" mishaps alone, there were half as many embarked (108) as there were disembarked (220).

Human error factors embarked as compared to disembarked are also worthy of note and are broken down by types of personnel. *Pilot-error-related* ground mishaps occurred 34 times ashore and only 5 times aboard ship. *Supervisory error* was cited 916 times ashore and 268 times afloat; *maintenance error* was involved 942 times ashore and 243 times afloat. *Support personnel error* aboard land-based facilities occurred in 799 cases and in 490 cases aboard ship. *Miscellaneous personnel error* figured in 124 mishaps ashore and 47 afloat. *Controlling personnel error* reversed the statistical trend in that 312 mishaps involving controllers happened aboard ship, whereas 144 occurred at air stations. The remaining mishaps in the grand total of over 3000 were attributed directly or indirectly to *material/design, weather,* and/or *other.* Once again, we are not pitting the communities against each other, but just trying to bring to light the alarming numbers of ground crunches that are affecting the fleet's overall effectiveness and costliness in men, money, and materials.

During the years from '75-'79, approximately 30 percent of the 3244 ground mishaps were GSE related, and 90 percent of these were related to *human error!* As indicated earlier in this article, the crunches increased each year, less '76, and so did the GSE-related incidents. They rose from 171 in 1975 to 281 in 1979. Of the 978 total GSE crunches in 5 years, 284 were aboard ship and 694 were on land.

As a final note of interest, let's take a look at the "A," "C," and "D" damage and major causal factors by community over the years '75-'79. Figure 1 depicts the total number of mishaps by community for embarked vs. disembarked environments. Figure 2 compares total mishaps to the number of mishaps involving human error by community for the 328

A, C and D Category Mishaps by Community

DISEMBARKED vs EMBARKED

1975-79

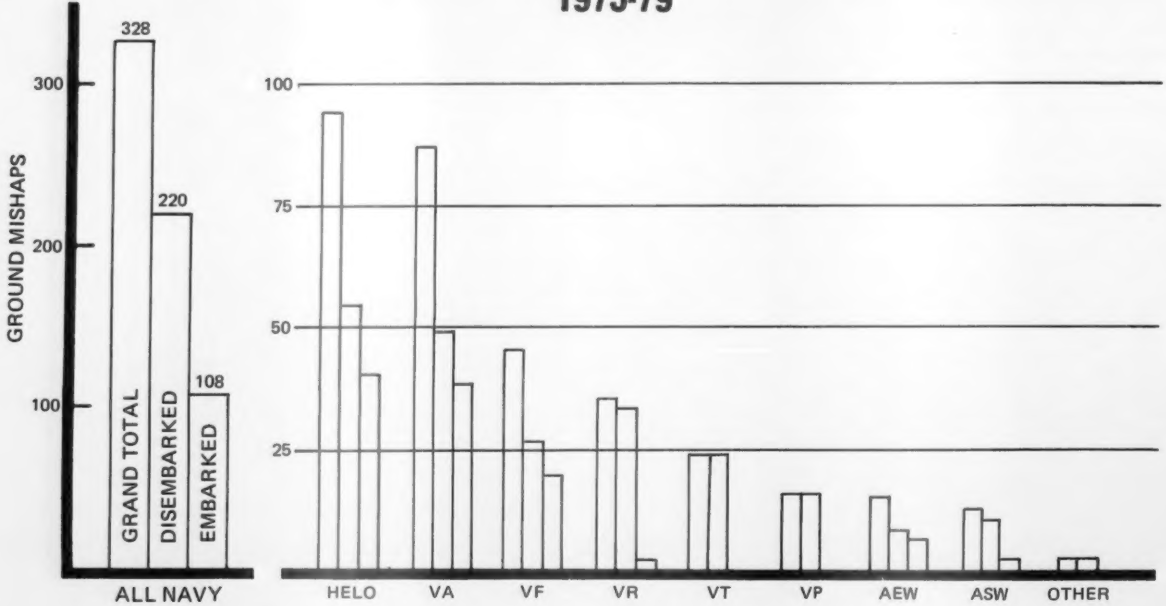

Fig. 1

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A, C and D GROUND MISHAPS vs HUMAN ERROR
1975-79

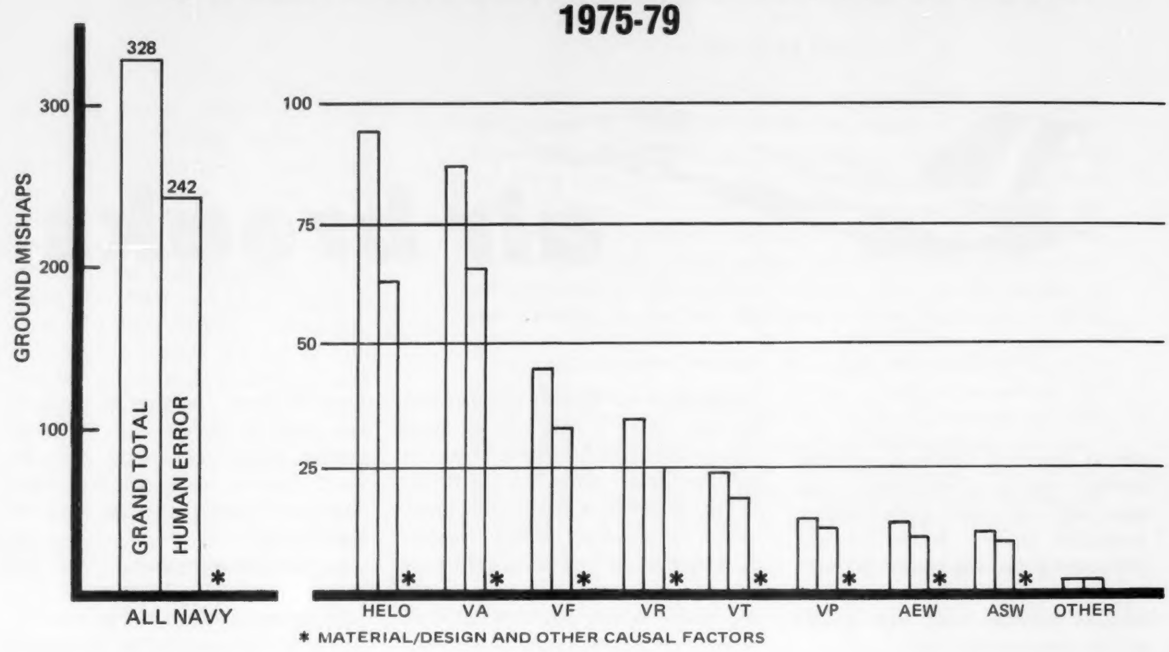


Fig. 2

"A," "C," and "D" ground mishaps.

Overall, the figures that you've seen do not paint a very optimistic picture, particularly if the trend of the past 5 years continues into the '80s! The past 5 years of ground mishaps cost naval aviation 13 lives, seven aircraft (ALFA damage), 150,000 man-hours, and about $110 million. It's unfortunate we can't compute the exact loss of training and readiness affected by these 3244 ground mishaps, but it was obviously great.

And how about the *unreported* mishaps? Hopefully there haven't been too many of them. If they are not being reported properly, it's well past time to do so. By following the latest OPNAVINST 3750.6, *Naval Aircraft Mishap Reporting Procedures,* and with a viable command ground safety program, maybe, just maybe, the trend of the past 5 years will be reversed in the '80s and the number of mishaps will be cut in half rather than double as it did from '75-'79.

air breaks

Got It Wired. A CH-46, at a civilian airshow, was air taxiing over a rough grass field into a static display position designated by the airport manager. The route of taxi was parallel to powerlines at the rear of the static display area, to minimize rotor wash to light aircraft already positioned.

The pilot was executing a 90-degree pedal turn into position when a light aircraft to the immediate right began to move from the rotor wash. The crew chief cleared the helicopter left and then moved aft to recheck the rearward clearance. He next directed the pilot to move forward because it looked like the rotors were between wires.

The pilot began to ease forward and the rotor blades struck a cable strung between power poles, leaving approximately 2 feet of cable lodged in one main rotor blade. A slight vibration was noticed as the helicopter taxied clear of the remaining wires.

The pilot failed to properly clear the aircraft in a confined area. With obstacles surrounding the static display area, and a rough grass area which precluded ground taxi, there was no safe entrance through which the helicopter could be taxied. Pilots must remember that the congestion and confusion associated with most airshows can easily lead to a lapse in crew coordination. The responsibility of helicopter pilots to ensure safe clearance at all times cannot be overemphasized.

A Reminder for Aircraft Commanders. At the end of a long day of flying logistic/administrative flights in venerable yet ancient birds like the C-117, C-118, or C-131, it would seem easier, as the AC, to instruct the flight engineer or crew chief to "put her to bed for the night," rather than stick around until the mission is truly completed. But, it's often easier said than done, as witnessed by those left to finish the job at NAS Reserve.

After unloading its passengers at the transient ramp, the AC departed the area for home, after instructing the FE to taxi the C-118 back to the VR line. Possibly being a little bit anxious to get home himself, the FE "wheeled" the C-118 sharply to starboard, striking the passenger boarding ladder with the port horizontal stabilizer. Fortunately, there was only minimum damage and no injuries were incurred as a result of this "careless" assumption and "hurry up" attitude demonstrated by all concerned. Everything pointed to extreme caution – dark ramp, no wingwalkers available, lack of positive communication, and limited ramp space – but it was not practiced that night. The flight engineer, although experienced, *was not* properly certified at the time of the incident, nor were the ramp conditions or undermanned/unprepared duty section conducive to safe operation. So, ACs, don't be in such a hurry to display "get-home-itis," in the air or on the ground! The flight's operation begins and ends with you. It's your responsibility, right?

Servicing Goof. The crew of an SH-2F was ready to launch when the plane captain noticed oil leaking from the No. 2 engine lower cowling door. The plane captain gave the HAC the signal to cut.

A troubleshooter took a look and found out the No. 2 engine oil tank filler cap had not been secured properly. The pilot had found the No. 2 engine oil level was low during his preflight inspection. He requested servicing.

Maintenance control sent out a plane captain trainee to fill 'er up. After completing the task, the trainee failed to secure the oil filler cap. That oversight was bad enough, but what is even more important is that neither pilot nor the regular plane captain inspected the trainee's work.

We're sure that we're only talking to 2 percent but, in case there are more, we state most emphatically that old heads have to be more alert, more suspicious, and more conscientious in inspecting and checking work done. Let's see what was involved:

- The trainee's work was not inspected. Was the goof due to inattention or ignorance?
- Inadequate supervision by the regular plane captain. Was it due to indifference?
- Incomplete preflight by the pilot. Was it due to an inappropriate feeling of superiority?

Sooner or later, inattention, ignorance, indifference, or a pilot's attitude that "I'm above all that" will kill someone.

Pro of the Month

DURING carrier operations aboard USS INDEPENDENCE (CV 62), AA Leamon E. Thebeau of VF-102 was assigned to make a routine turnaround inspection of one of his squadron's F-4Js. While inspecting the intake ducts, he noticed that the starboard engine was positioned slightly different than usual. He alertly summoned maintenance QA personnel, who performed a powerplant inspection. This investigation revealed a cracked and loose engine slide rail, and one engine mount partially separated from the aircraft structure. Had this discrepancy not been detected, it very well could have led to an engine fire or failure airborne.

Airman Apprentice Thebeau's particularly close attention to detail during fast-paced carrier flight operations is truly commendable. His safety awareness is unusually keen, and his positive attitude towards his duties is a credit to not only himself, but his shipmates and supervisors as well. His professionalism very possibly saved this *Phantom* and its crew. This action definitely improved the safety awareness of all personnel in the squadron. To Airman Apprentice Thebeau, a well earned – WELL DONE!

Lightning Strikes Twice. For those who believe lightning doesn't strike twice in the same place, they should talk with two pilots of a west coast composite squadron. *Both* were flying the same mission, the same TA-4J, almost in the same exact spot, a fortnight apart. *Both* were hit by lightning, *both* lost their TDU-22 tow targets, *both* had to jettison the rest of their tow cable, and *both* returned to base without any damage or injury incurred as a result of these separate incidents. *Bermuda Triangle* west coast style? Just coincidental, maybe!

Skyhawk-1 was performing a ship's service mission at 275 knots, 2000 feet MSL, in VMC, towing an aerial target by 15,000 feet of cable. The aircraft was struck by lightning, which discharged on the refueling probe. The pilot heard a muffled explosion and received a prolonged shock (5-10 seconds) through his hands. In an attempt to gain separation from the nearby clouds, he inadvertently dragged the TDU-22 through the water (ocean), consequently losing it. He jettisoned the remaining wire and returned to base without further incident.

Skyhawk-2's story was just about identical to *Skyhawk-1's.* The lightning struck either the aircraft or the cable close to the aircraft. The pilot observed a muffled pop and bright flash in the periphery of a nearby isolated rain squall. The ship being serviced reported loss of radar contact with the target. The pilot made two low passes by the ship and the loss of target was confirmed. The pilot jettisoned the remaining wire and he, too, returned to base without further incident.

Although both aircraft were operating in VMC, they were in the vicinity of rain showers. Streamed cable operations, under conditions where lightning can be expected, allow little latitude for remedy other than see-and-avoid. Pilots must ensure a thorough weather briefing for *all* missions, particularly when CBs are in the area. Their wrath is unpredictable and should be avoided at all costs.

Lightning strikes on aircraft are being reported at a rate that seems to be on the increase. In CY 78, no less than 58 were reported to the Safety Center. There were 36 reported in CY 79 (over $300 damage). The point should be clear . . . beware of THOR. He's around all year, be it summer, winter, spring, or fall, and can give you static whenever sparked into anger. ◄

"Simple" Human Error

By LT Paul Laedlein
HSL-31

A HELICOPTER pilot accepts a familiar VFR approach route to the field in spite of the fact that, with the given winds, his approach will be almost directly downwind. As the aircraft transitions to a hover, the relative wind is on the port quarter at about 13 knots. With the application of collective power, the nose begins to yaw right (a normal tendency in tail rotor helicopters). By the time the helo has turned 30 degrees, the pilot has applied full left pedal without stopping the yaw. He adds collective to avoid the deck and, with the additional torque, the turn rate accelerates. As the aircraft rotates through 45-90 degrees of turn, he calls out, "I'm not doing this," and the aircraft commander seizes the controls. After one complete revolution, and believing that the aircraft has lost tail rotor thrust, the copilot secures both engines. The helicopter falls about 60 feet, inducing strike damage. The subsequent investigation reveals no mechanical malfunction. In fact, a combination of very ordinary circumstances resulted in a situation which provided just enough sensory cues to one of the pilots for him to incorrectly identify the problem as a loss of tail rotor thrust. Had he correctly identified the emergency, his response would have been correct.

You can call it inappropriate or improper pilot response, lack of flight discipline, or attribute it to training deficiencies or failure to learn from previous experience; generally, it's pilot error. More basically, it's simple human error, and simple human error is the most complex cause of mishaps. It is also the largest single cause of accidents in a highly technological society, aviation or otherwise. In a sense, of course, all accidents can be traced to some sort of human error, but understanding human error requires seeing it simply as an unintended action – something completely different from error caused through ignorance, neglect, or incompetence. This is the key to understanding why, after countless safety standdowns and hundreds or thousands of accident-free flight-hours, even the most competent pilot can misread a situation, misevaluate common sensory cues, and commit himself to a course of action which, later, seems obviously wrong.

In 1971, a major European airline tested pilots working under the high workload conditions of takeoffs and landings. They found that, on the average, their pilots made no less than 15.6 errors an hour. Similarly, a 1977 NASA study which included inflight emergencies found that pilots committed errors at the rate of 11.4 an hour.[1]

The study of human error as a natural condition of life is the job of human factor psychologists such as Dr. Donald Norman, a theoretical psychologist on the staff of the University of California at San Diego. Writing for *Psychology Today* Magazine (April 1980), he explains his view of the human mind as an exceedingly complex computer, and human errors as slips, caused when stray information or miscues throw off the normal information-processing mechanisms. Human factor psychologists believe that people commit errors routinely as a fundamental byproduct of the same mental processes which produce their great creativity and flexibility. Most actions, such as the coordination and operation of the specific muscles needed to carry out the task of selecting and positioning a switch or physically producing the words of a radio transmission, are carried out by subconscious mechanisms. Only the general selection of an action is carried out at the conscious level.

Dr. Norman believes that all plans of action are constructed from the mind's *bank* of countless, preprogrammed motor actions which are subconsciously selected and sequenced. The less skilled we are at a particular action or the more unfamiliar the sequence, the more specific the mind's conscious role must be. Conversely, the more habitual the action, the less conscious intervention is required in order to initiate and carry out a task. Habit patterns (familiar sequences of individual actions) include a wide variety of duration and complexity. They may be flexible or rigid in structure, deeply ingrained, or fairly superficial. They are absolutely essential, as they free the mind from the overseeing of minute tasks, enabling it to divert its attention to other matters. They also leave the door open for error, as the conscious mind becomes distracted and a well-established habit runs slightly off its course. Let's take a look at an example.

The aircraft commander was an exceptionally experienced helicopter pilot. He was familiar with two types of practice autorotations: in the first type, the engines remain in the flight range and a power recovery is executed; the second type involves the retarding of both engine condition levers (ECLs) out of the normal flight range until 500 feet AGL, at which time they are returned to FLY and a normal power recovery autorotation is performed (demonstrating rapid rotor RPM decay with a dual engine failure). With the exception of returning the ECLs to flight condition at 500 feet, the two autorotations, once stabilized, are procedurally identical.

In this particular incident, the pilot at the controls had difficulty controlling the aircraft's drift during the second type of practice autorotation. The HAC momentarily removed his hand from the ECLs in order to assist in making an aircraft attitude correction. The autorotation was continued to completion, where it was evident that no power was available for recovery. A hard landing resulted.

Among other causes, the Board attributed this accident to "lack of habituation" and "lack of flight discipline." It's important to realize, however, that while a stronger habit pattern with recent reinforcement for the critical procedural step may have permitted the HAC to recognize his error in time to correct it, it probably would not have prevented him from making it. Habituation will never eliminate the tendency to commit errors, but flight discipline (if it means constantly and diligently reassessing a developing problem) may permit catching them early.

Fortunately, the vast majority of simple human errors are caught and corrected by the mind's own conscious monitoring processes – checking the observed result of an action against the intended outcome. The mistake results in a condition which immediately gets our attention. On the other hand, the dangerous errors are those which do not result in some obvious reminder. They rely on memory alone to correct them, and are the human errors most often overlooked.

The human mind deals with its environment in as high a level of abstraction as it reasonably can. It absorbs just enough information to recognize what it sees and then, using experience and knowledge, selects a course of action in response. This process is constant, usually taking place in several different levels of thought at the same time. The ability to quickly assess a set of sensory cues, consider them in abstraction, and respond to them allows for quick decision-making and adaptability. But this can also be a dangerous mental shortcut for the unwary, resulting in overlooked details, underestimated hazards, and misinterpretation of actual fact.

Human error under conditions of stress, such as an inflight emergency, is affected by another variable – the individual's physiological and emotional response to the situation. This response, coupled with the habit pattern already developed in preparation for the emergency (or developed as a result of experience in similar circumstances), will determine, in large part, his performance. Psychologists learned long ago that, while some level of stress improves performance, high anxiety or intense emotional response can actually impair performance to a significant degree. The prevalence of simple human error increases under stress. There is an increased tendency to misinterpret or disregard cues and to respond to partially constructed concepts of what is occurring.

Another mishap serves as a good example of this phenomenon. During a cross-country flight, one of an aircraft's two engines was secured in order to extend the range. After a period of time, the remaining engine suddenly emitted a loud whine. The aircraft commander prepared for an emergency landing, broadcasted a "Mayday" call, and secured the engine. On the way down, the copilot twice restarted the other engine. Each time, he believed that he had been unsuccessful, even though he later reported that the cockpit indications were normal under the circumstances. After the crash and during the egress, the copilot discovered that the engine he had been trying to restart was running normally, at idle. Both pilots in this accident were very experienced in the aircraft model and

quite competent in general. Yet, under the stress of the emergency, the copilot seemingly misread the cockpit indications for a normal start and reacted instead to what he expected to see – an unsuccessful start.

Interestingly, studies have shown that if one removes all those who have had an accident in the preceding year from a given population, the accident rate in the subsequent year will not be affected. While training can sometimes reduce the rate of human error through the strengthening of habit patterns, no one is exactly sure why, since examples of individuals who err in those areas in which they are most experienced are legion.

Training to strengthen existing habit patterns does not seem to be the most effective method for dealing with human error as a cause factor of accidents. For example, it would be a serious mistake to stress reliance on memorized steps and prescribed emergency procedures, past the point of propriety, at the expense of good solid analysis and simple common sense. Emphasis must be placed on the conscious monitoring of habit patterns, both to prevent and to catch and correct the *simple human error.*

[1] John W. Senders, "Is There a Cure for Human Error?" *Psychology Today*, April 1980, Vol. 13, No. 11, p. 58.

℞: Drug Notes

COCAINE

Cocaine, street names "C," "Coke," "Heaven Dust," "Snow," "Junk," "Mexican Mud." It is the primary active ingredient of the South American coca plant, one of the family of psychotropic drugs whose primary effect is to alter mood and behavior by acting on the central nervous system. Cocaine is the most powerful stimulant known.

Use Symptoms: It acts on the central nervous system with lightning speed, causing sensations that can run from delusions of giddy well-being to outright paranoia. The main pharmacological action of cocaine is to block the generation and transmission of nerve-impulses. This blocking action, which is effective on all types of nerve fibers, is reversible; when the drug is absorbed into the blood and carried away from the site of application, the neurons return almost immediately to normal functioning.

Other Indications: If sniffed, the small crystals are abrasive to blood vessels in the mucous membranes lining the nose; with continued use, these vessels become constricted. Necrosis and perforation of the nasal septum may occur. Large doses of the drug which reach the heart may cause immediate death as a result of the drug's toxic action on the heart muscle. Blood pressure at first rises, then gradually falls as the central stimulation produced by cocaine is followed by depression. This depression will continue, if the dose is high enough, until respiratory failure results in death.

Treatment: In view of the lack of tolerance and withdrawal effects displayed by cocaine, the drug cannot, in a strict sense, be termed physically addictive. However, a pattern of "psychological dependence" upon cocaine can develop which has a number of adverse consequences for the user.

Legal Aspects: Cocaine is classified as a Schedule II drug under the Comprehensive Drug Abuse Prevention and Control Act. Under Federal law, simple possession of cocaine is punishable by a prison sentence of up to 1 year and a fine of up to $1,000, or both; manufacture, distribution, or possession with intent to distribute is punishable by imprisonment of not more than 5 years and/or a fine of $15,000, with the maximums doubled for second offenders.

BRAVO ZULU

LTJG Gary Dobson

IT is well known that things happen fast and that there is plenty to worry about during the takeoff and landing phase of each flight. These are critical phases in any flight; add a distraction or an emergency and they can become deadly phases.

Before you take off, are you mentally prepared for the unexpected? LTJG Gary Dobson of VF-43 was! At 1500 on the afternoon of 1 April 1980, LTJG Dobson launched on a "routine" instrument training flight with his student, LT Charles Baucom, in a TA-4J at NAS Oceana, Virginia. Immediately after raising the gear, he noticed the nose landing gear was indicating "unsafe." He requested a low pass by the tower for a visual check of his configuration. He made a normal turn-in from the abeam position while descending to 500 feet AGL at 180 knots.

As the aircraft passed the 90 degree position, a bird was ingested down the starboard intake. There was engine vibration and some thrust loss. Correctly analyzing the situation, he left the throttle set, declared an emergency, lowered the gear, flaps, and hook, and made an uneventful arrested landing. He immediately shut down the engine to preclude further damage. Postflight inspection of the engine revealed extensive damage, and it is estimated that the engine would have continued to operate for less than 1 minute.

LTJG Dobson's coolness and professionalism enabled him to analyze the situation and react correctly and promptly to save a valuable aircraft. LTJG Gary Dobson — well done!

This is the sixth article of our series on vertigo and disorientation. As usual, we suggest you read the last five articles before reading this one, for background purposes. We will discuss the remaining important manifestations of disorientation in this article.

By CDR V. M. Voge, MC
Naval Safety Center

Where did I say I was?

Flicker vertigo. Flicker vertigo is usually caused by a flickering visual stimulus. Although this illusion is probably more common to you helo drivers, the jet jocks and prop drivers also can be affected. How, you ask? Well, how about the spinning prop and an appropriate sun angle. This can result in a flickering light stimulus that can cause flicker vertigo. You jet jocks aren't immune either! How about when you're in the clouds and your strobes are reflecting off of them? (And you always wondered why you're asked to turn off the strobes in clouds!) Not only this, but flashing, anticollision lights can also illuminate the cockpit, either directly or by reflection from clouds or snow.

Okay, now that we know how the *flicker* gets there, how do we know when we've got flicker vertigo?!? Most aviators describe a feeling of nausea, dizziness, irritability and/or distraction, along with feelings of uneasiness, nervousness, drowsiness, headache, or even severe pain. Occasionally, an aviator will report *true disorientation*, in which he feels as if he is turning in the direction opposite to that of the moving shadow. In a few, rare, severe cases, people have become unconscious or have suffered epileptic-like seizures (fits or convulsions).

All this sounds a little strange, doesn't it? It is caused by the frequency of photic (light) stimuli to the brain. A medical officer will frequently use a strobe light during an electroencephalographic (EEG) test to try to induce seizures in patients. (Remember your preflight physical?) The same mechanism is present here. Unfortunately, and as usual with vertigo and disorientation problems, you will probably not realize what is happening to you. Although the possibility of your being affected by this form of vertigo is slight, the results understandably could be catastrophic!

The cure – easy, usually. Simply get away from the flickering light. Change course, turn off the strobe or anticollision lights, or change your field of vision. If you find you are suffering from flicker vertigo, and are in a dual-piloted aircraft, close your eyes and turn your head away, *briefly*. You needn't make a production of it!

Circularvection and linearvection. These are two illusions produced from a movement in your peripheral field of vision. This will give you a feeling of self-motion. If it is a false sense of rotating motion, it is called *circularvection.* You might experience this from the revolving reflection of your anticollision lights off clouds. It also can be produced on the straight-and-level, parallel formation flight when aircraft are flying at different speeds.

If the sense of motion is linear, it is called *linearvection.* How many times have you stomped on your brakes at a stop light to keep from rolling backwards when the car next to you

"I know this sounds flakey, Bub, but I've misplaced the horizon . . ."

actually has crept forward? This illusion can be produced when two aircraft are ahead of you and are rapidly separating. You feel as if an aircraft is approaching you. This also occurs when your approach to a fixed object is misjudged, and you feel as if the object is actually coming towards you. This illusion probably explains some of the problems a few of you had when you first learned formation flying.

Misplacement of horizon. Misplacement of the horizon can occur in several different scenarios. Lights normally provide you with critical information, e.g., horizon, attitude, runways, traffic patterns, position in formation, and type of aircraft. This illusion primarily involves a misinterpretation of the meaning of the lights you see or of the distance and appearance of the object at night as compared with its appearance in daylight. It is generally associated with night flying and certain other conditions. Examples:

- At night, approaching ground lights may be confused with stars, giving you a false horizon. Depending upon the lights' relative orientation in relation to the horizon and flight direction, it can give you the feeling that your aircraft is tilting. Some pilots have even reported feeling inverted! A few of you have been known to interpret the shoreline lights as the horizon and to maneuver your aircraft a little too close to the murky depths. Although this doesn't happen all that frequently, you can well imagine the consequences!
- When flying over a sloping cloud deck or sloping terrain, without visual reference to the earth's surface, you may experience a visual form of the *leans* (see APR '80 APPROACH article). This can be extremely annoying and may dangerously affect your flying efficiency. The tendency is to accept the sloping terrain/cloud deck as the horizon, ignore the attitude indicator, and align the aircraft with the perceived horizon.
- Ground lights can be confused with stars. This can result in rather bizarre aircraft attitudes in order to keep the "stars" above you! You also may misinterpret your approach to a star or fixed beacon as though you were following the tail lights of another aircraft in formation! Ever join up on a star?! Whenever you're flying in a sensory-deprived environment (few visual cues), your requirement for some point of fixation makes you susceptible to this illusion. You are more susceptible to these illusions if you're under stress. Your best defense against it is *to be aware* of the problem (which you are now) and to watch for it. Also, watch your instruments. A proper scan is of utmost importance!

Another illusion, and space myopia. Another illusion, with no specific name that we are aware of, occurs when you suddenly shift your attention from outside the cockpit to inside the cockpit (to the instruments). Although the eye's ability to accommodate is almost instantaneous, it may require up to 45 seconds for your *mind's eye* to become completely reoriented. Some serious problems understandably may develop during this time period, especially when you consider that this type of shift in attention is often the result of a developing problem with the aircraft! The reverse of this is space myopia, where your eyes remain focused to near vision (cockpit, wing, etc.) while you're scanning the sky for playmates. Solution: *Be aware* of the problem, and get on the instruments in the former case. (We're beginning to sound like a parrot with a very limited vocabulary.) In the latter case, try to find some far-off, visual point of reference to focus on.

Approach and landing problems. As we stated above, when we don't have all our normal visual cues, or they are not what we've become accustomed to, we can make errors of perception. We can overestimate distance in degraded atmospheric conditions, e.g., fog, rain, haze, or snow. If you are making a visual approach, you may feel that you are higher or farther from the runway than you actually are. Your approach may be high, and you may overshoot. On the other hand, if you've become used to flying in the "muck" and the atmospheric conditions are better than what you're accustomed to (e.g., clear, bright conditions at a high altitude airfield), you may feel things are a bit closer than they actually are.

As we explained above, darkness deprives you of a generous amount of your visual field, and you no longer have the various daytime visual cues to depend on. You then rely on what is called your *angular subtend*, or the relative size of the runway and approach light pattern on the back of your eye

"You're just saying it's an illusion because it's my turn!"

(retina). This is more difficult if you are making a "black hole" approach (over water or unlighted terrain, for the uninitiated). Many pilots feel that they are higher than they actually are under these conditions and fly a low approach. You can also misjudge distance from the runway threshold (bright lights = underestimation of distance; low lights or poor atmospheric conditions = overestimation of distance). This illusion may account for the difficulties some of you experience when you don't *fly the ball.*

The runway and surrounding terrain may cause you problems. You may tend to make a low approach and land short on a runway which slopes up from the threshold. Why? You overestimate your altitude and distance to touchdown. Conversely, you are more likely to make a high approach and land beyond the threshold if the runway slopes down. All this happens because your *mind's eye* tries to match up the image of the sloping runway with what it's become accustomed to on the more familiar flat runway using a 2½- to 3-degree glide slope (assuming you normally land on flat runways, of course).

The same problem can exist when you approach a runway with dimensions that are different from those to which you're accustomed. An unusually wide runway will tend to cause you to underestimate distance, and an unusually narrow runway will tend to cause you to overestimate your distance from the threshold, leading to landing long or overshooting. To carry this just a bit further, the confusion can be even worse on those runways that preserve the expected length/width ratio, but are wider and longer or shorter and narrower than expected.

Last, but not least, local topography is important. An approach over generally featureless terrain ("black hole" approach, smooth sea, snow-covered ground, night conditions over water or dark terrain) can cause serious errors in your perception. Sloping terrain can give a false perception of height just as can sloping runways.

The big problem with these illusions during approach and landing is that you just don't have much time and altitude to correct for any misperceptions. The decision to shoot a missed approach must be immediate, if you're going to avoid a coveted place on the Safety Center's computer tapes! The illusions mentioned above usually don't occur one by one, but rather occur in various and sundry combinations, just to confuse you further. Your error will be one of judgment and inappropriate control. How to avoid this one? Be aware! Be alert! And remember, not all approaches can be saved. Swallow your pride and go around. After all, we need all the landing practice we can get, don't we?!

Polaroid sunglasses. Ever wonder why polaroid sunglasses are a "no-no" in the cockpit? Well, there are various reasons, most of which we won't go into. As far as disorientation is concerned, however, the Safety Center received a report which described a strange illusion of a pilot while wearing polaroid sunglasses under a clear visor. He was flying low, over the ocean, in the late afternoon. He looked at a ship underway in the distance, and the forward part of the hull appeared to be suspended over the bottom of the ocean! Because of the sun angle, and his polaroid sunglasses, there was no reflection from the water. The aviator was disturbed and described the feeling as "disconcerting, to say the least." He asked us whether any collided-with-the-water accidents could have been caused by this phenomenon. We don't know, as after someone has collided with the water, there isn't anyone left to talk to. We would probably never find the sunglasses, anyhow. What caused this illusion? Hard to say. It could be attributed to any number of factors, e.g., effect of the visor over the glasses, make of the lens, prism balance, light ray bend, etc. We do know that polaroid glasses are designed to cut glare from the water's surface by polarizing the light rays. They are even advertised for use by fishermen to *see* the fish through the water! Solution? Simple! Don't wear polaroid sunglasses. Use only authorized, standard issue, naval aviator sunglasses.

Well, at long last we've come to the end of our long enumeration of the various illusions caused by vertigo and/or disorientation. We haven't covered them all, but we've at least hit on the most important. Next month, in our final article in this series, we will wrap everything up, give some general explanations, pointers, warnings, and most important, coping mechanisms, or "Now that I'm thoroughly confused as to where I am or what my attitude is, what do I do next?"

All work and no NATOPS make Jack a dull thud . . . and history, too.

Ace L.

Quality Assurance Incident Reports

DON'T IGNORE THEM

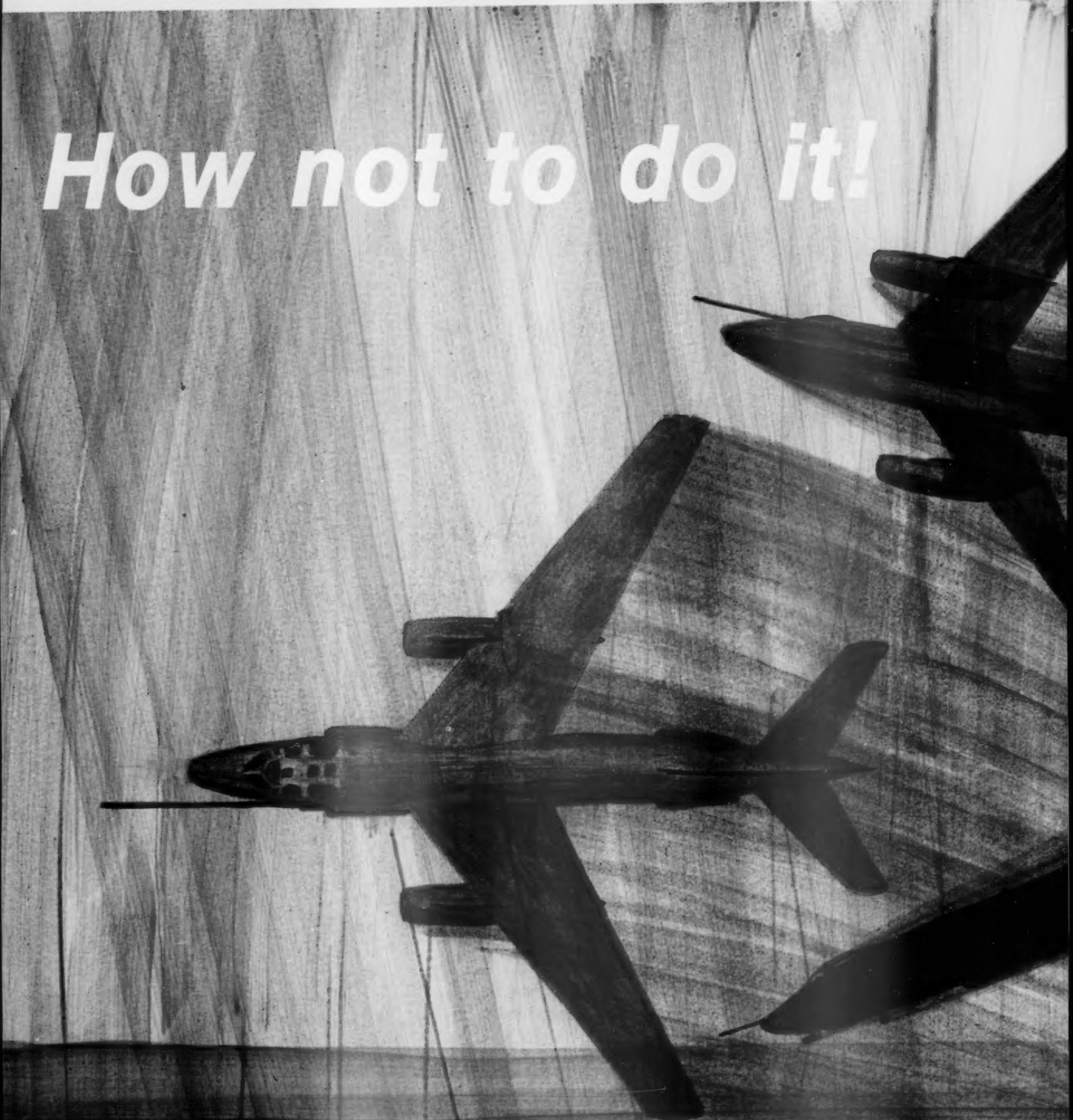
By LCDR D. R. Bouchoux
VF-24

IN the course of reading any aviation squadron's message board during a short period of time, one would likely encounter one or more Quality Assurance (QA) Incident Reports. These reports, written under guidelines contained in OPNAV 4790.2B, may pertain to the type aircraft flown in the Navy/Marine Corps community. The guidelines outlined for these messages call for the inclusion of part numbers, federal stock numbers, manufacturers, etc., and a narrative description of the circumstances surrounding the report. It is in these narratives that one can occasionally glean a valuable safety lesson. Let's look at a few quick examples.

A QA Incident Report chronicles chafing followed by arcing of an electric wire bundle against a line leading to a hydrator unit for an F-14's oxygen supply. The result — a popped circuit breaker in the rear cockpit. A year later, in a different aircraft, the same circuit breaker is found popped. Investigation yields the same situation, with arcing occurring in the compartment holding the liquid oxygen — a potentially explosive situation. The problem is mended and the aircraft is safe for flight.

Another QA Incident Report tells of an F-14 with external tanks aboard having a stuck valve, preventing the fuel transfer from one of the tanks. Operating in *blue water operations* with no bingo field available, this would, if not rectified, normally call for the jettisoning of the full tank at a high cost to the taxpayer and to the squadron's maintenance effort. In a desperate attempt to get the fuel transferred, the pilot cycles both generators at the same time. *Voila!* The sticky valve opens and the fuel transfers. Two weeks later, the same procedure works in another command.

These examples have been from one type of aircraft, but each Navy/Marine Corps community could add similar situations. There are lessons to be learned about areas of common interest from P-3s to F-14s and back. These somewhat innocuous reports are not just for the consumption of the maintenance department; among all those federal stock numbers there may be a lesson to be remembered that can save a sortie, maintenance effort, or possibly even an aircraft. So, the next time you pick up your squadron's message board, give a little extra attention to that QA Incident Report — it could be the most valuable 5 minutes of your day.


How not to do it!

Name Withheld by Request

AFTER years of living with the memories of my worst night of naval aviation, I guess it's time to write about it so someone else might learn from my experience.

It was the last night of a predeployment workup prior to sailing for the Mediterranean. Our three *Whales* were part of a 25-airplane flyoff to NAS East Coast to reduce the deck loading for a one-night, RAG, carqual period. The ship was scheduled to pull into port the next morning and sail 1 week later. Our early afternoon flyoff was normal in all respects, and the flight lead, our skipper, was happy to learn all our aircraft were up when we got ashore. He emphasized how important it was for the planes to get back to the ship that night. Otherwise, we would have to fly to another base and be craned aboard – "Something we want to avoid at all costs."

The fly aboard was scheduled in two recoveries of 12 and 13 aircraft after the carqual evolution. We had arrived at NAS East Coast at 1500 and were scheduled for the 2100 recovery aboard USS SHIP. However, we were to wait for a confirmed overhead time via Raspberry before we manned our aircraft.

I went to the BOQ, where I got some chow, and then to my room for a 2-hour combat nap (the smartest thing I did all day). Two hours later, my crew and I attended the three-plane *Whale* flight brief. Unfortunately, the brief was rather general, covering not much more than the rendezvous and breakup for individual Marshals; no inflight emergencies were addressed. I reviewed some individual emergencies with my crew, another nugget and an AT3, and returned to the BOQ for word from the boat.

After awhile, it became obvious things weren't going as planned with the RAG carquals. Our original overhead time of 2100 came and went with us still waiting in the BOQ. Around 2300, we got the word to man the aircraft. All 25 aircraft were to return to the ship at once! By this time, we all were tired of waiting and glad to be heading for our aircraft.

Our preflight, start, and taxi were normal, and I was happy to see that we were apparently ahead of everyone else, as none of the other air wing aircraft had taxied yet. Our three *Whales* taxied to the hold-short line with me as number three. I thought it was odd that number one and two had parked in the hold-short area in such a way as to block traffic, but the press of getting the takeoff checklist completed blotted these thoughts from my mind. With our checklists completed, the lead switched us to Tower. It was immediately obvious something was wrong with the lead's radios; both his No. 1 and No. 2 radios (one on Tower and one on Ground) were constantly transmitting static and cockpit conversations. The lead tried several transmissions, requesting takeoff clearance and acknowledgement of the frequency shift from the other aircraft.

Confusion began to reign supreme. NAS East Coast Tower tried calling on Guard, Tower, and Ground frequencies to tell the lead he had a stuck mike. I knew there was more to it than that, so I told my AT3 aircrewman to run over and get in the lead's aircraft through the lower hatch and clarify the

situation. By this time, the other air wing aircraft were lining up on the taxiway behind us. I was somewhat surprised to see the lead's aircrewman running over to number two and then back into his aircraft. Suddenly, the radios were clear and I told number two that we should clear the hold-short area so everyone else could take off. He agreed, and as the dance of the *Whales* began in the hold-short area, I very nearly taxied off the taxiway into a big mud puddle. Finally, we were clear and waited while the rest of the aircraft took off.

As we were sitting there, I noticed someone again get out of the lead's aircraft and go over to number two. I gulped as number two, a nugget also, informed me on squadron common that the skipper wanted him to lead the flight back to the ship and that the skipper would fly on number two's wing, **NORDO!** We discussed the wisdom of doing this and decided to send one of the navigators over to talk to the skipper to see if that's really what he wanted to do. The navigator, another nugget, returned with the word we had to get back to the ship and that's what we were going to do. So, we switched to Tower and number two transmitted, "East Coast Tower, AZ 611, flight of three for takeoff. My wingman's NORDO." After a long pause, East Coast Tower said, "Well, we can't really clear an aircraft to take off NORDO, but if he wants to, I guess it's alright with us. You're cleared for takeoff; the wind is calm."

As the new lead took the runway, I noticed the skipper was not taking the runway as number two. Thinking he must have thought better of his plan, I took the runway as number two and rolled down the runway 10 seconds after my new lead. I rendezvoused on the lead, and the two-plane flight headed towards the ship with the skipper nowhere in sight. We motored on for awhile when, suddenly, another set of aircraft lights appeared, closing fast. We soon had the skipper with us and pressed on to USS SHIP.

At the ship, the carqual period was finally ending, and the recovery was marshaled to await a push time. Number two switched our flight to Marshal, and as he did that, the skipper decided to try his radios again on Marshal frequency and the one approach frequency being used for the recovery.

Pandemonium broke loose on the radios. The ship and everyone concerned tried transmitting to the skipper that he had a stuck transmitter. The confusion forced the ship to bingo the remaining carqual birds on Guard frequency. Finally, the air wing aircraft got switched to a new Marshal frequency. Unfortunately, in the ensuing confusion, I lost radio contact with the lead. Now we had three *Whales* flying formation at night, none of whom had communications with one another.

Frankly, I was scared by now. I tried to transmit my situation to the ship and get an individual Marshal. I tried every frequency on the card that should have worked, and all I got was static or silence. In the midst of these radio changes, I suddenly noticed the lead was descending, and without warning, he put his speedbrakes out. I just barely avoided a midair by pulling up and to the right. As I pulled up, I was shocked to see the complete underside of the skipper's aircraft on the left, in a 90 bank to avoid the lead. That was the end of formation flying that night. I cobbed the power and climbed as fast as I could. Finally, I was able to get through to the ship on Guard, and they switched me to a clear frequency.

The skipper, now on his own, decided to make his own approach to the ship. We had no emergency Marshal information to fall back on, so he circled the ship and, when he saw a hole develop in the pattern, descended, jumped into the night recovery pattern, and flew a night, visual approach. No one knew for sure who (or what) he was, so he was waved off on the first approach. He flew a normal NORDO bolter pattern and recovered aboard on the second pass.

By this time I was feeling better. Approach gave me individual vectors, and I flew one of the nicest three-wire passes of my life. As it happened, I landed just behind the skipper. As I got out of the aircraft, I saw the skipper walking down the deck and somehow suppressed my urge to kill. The remaining *Whale* was having his problems. Just after he had put out his speedbrakes for his approach, he had a utility hydraulic failure. This was complicated by the fact he was now below dirty bingo fuel requirements. He had been given instructions to tank, and had rendezvoused and tanked dirty. In the process, his flaps had bled up. He didn't notice his increased approach speed on his first approach after tanking. He floated high over the top and nearly flew into the water on a long bolter, which I witnessed as I cleared the flight deck. The LSO recommended a bingo and the ship directed the same, even though he was 1000 pounds below dirty bingo fuel requirements. Fortunately, he flew a good profile, received good handling by Approach Control, and landed with 10 minutes of fuel remaining.

Well, that was it. As I look back at all the mistakes we made, it's a wonder we weren't all killed in one big midair. All of us had the opportunity, but refused to break the chain of errors that precedes most accidents. Get-home-itis (our floating home, that is), inexperience, and complacency all reared their ugly heads. I only hope that this article has given you a good example of **how not to do it**, and that you won't let yourself be led down the garden path by an overzealous skipper, as I did.

We are creatures of habit with a built-in tendency to rely on what seems to conform with past experience.

Ace L.

A pair of pros

EXPLOSION! The nose of your aircraft pitches up and the whole aircraft experiences extreme buffeting. Your wingman breaks right and transmits, "Jettison your centerline! You're on fire!" A war story told by an old aviator? Not quite!

LTJG John Huie (pilot) and LTJG David Rutkoff (RIO) of VF-161 aboard the USS MIDWAY (CV 41) flew their F-4J *Phantom* on what seemed a normal missile exercise. All systems checked good, all parameters had been met, and a "Cleared to fire" had been given. The trigger was pulled to launch the *Sparrow* and the *normal* portion of this missile exercise ceased.

At the sound of rocket motor ignition, LTJG Huie and LTJG Rutkoff heard and felt an explosion. At the same instant, the nose of the aircraft pitched up and extreme airframe buffeting was experienced. The *Sparrow* exited from beneath the right side of the aircraft nose in a corkscrewing flight, then broke apart.

An extremely garbled call came from his wingman, "Jettison your centerline! You're on fire!" The UHF antenna of LTJG Huie's and LTJG Rutkoff's aircraft had been destroyed, along with their emergency jettison system. Almost immediately, a hydraulic failure and complete loss of all stability systems occurred.

The aircraft was brought under control and the centerline fire extinguished in short order. Attempts to "bomb off" the centerline were unsuccessful because the normal bombing circuits had also been destroyed.

LTJG Huie and LTJG Rutkoff then diverted to NAS Cubi Point where they lowered their hook and *blew down* their gear in preparation for an arrested landing. Good *down* and *locked* indications were received, but their wingman called their nose gear slightly cocked. A shortfield arrestment was made without any further problems.

Through this professional display of airmanship and flightcrew coordination, LTJG Huie and LTJG Rutkoff saved a costly Navy aircraft and provided valuable insight into why the *Sparrow* failed to function properly. Attaboy to both of these gents.

CONFESSIONS OF A NAVCOM

AS aircraft navigation systems become more and more sophisticated, so does the job of managing them. These days, navigators are rarely called upon to perform basic navigation, but rather, are required to evaluate and integrate computer generated information – information which is seldom incorrect. But what about the time that it is bad? Are you going to recognize it? And more importantly, are your basic navigation skills going to be practiced enough to avert disaster?

The setting: Far East. The squadron was in the final month of a very demanding WestPac deployment. Crew seven, my crew, had risen early to begin our 0200 preflight. The mission for the day was a routine maritime surveillance flight. Our track would cover a large ocean search area bounded by foreign land masses. I was especially alert to the need for precision navigation in order to avoid a violation of any foreign air space.

Preflight proceeded smoothly, with no unusual events. After reviewing the aircraft maintenance logs and noting only minor discrepancies, we proceeded to the tactical brief. Weather for the northern area of our track was forecast to go from bad to worse during our *on station* time. Mid-December storms in this area are sometimes brutal, and this one was no exception.

With the electrical storms and low ceiling rendering LORAN and celestial navigation useless, I had to anticipate using only radar and, possibly, ADF for outside fixing information. I wasn't worried, because the P-3C has dual inertials and a nav computer that would keep me in the ball park. What could possibly go wrong? . . . Plenty!

At 0600, the mighty *Orion* marked the numbers and started her takeoff roll. The navigation system was updated, and I noticed the inertial positions had drifted about 2 miles since the initial alignment in the chocks. This was excessive and cautioned me to keep a watchful eye on them. Immediately after takeoff, we began experiencing problems with the navigation radios. Unable to determine if the problems were due to the gear or the stations themselves, we elected to continue the mission and rely on the nav computer for steering commands. During the 45-minute transit to our *on station* point, we were able to obtain one VOR mark on top, but had to miss our last mark on top prior to going "feet wet" because of weather avoidance. I had been counting on one final update of the nav systems with this last mark on top, for I had been busy preparing tactical messages and conducting post-takeoff systems checks and had missed our only VOR mark on top. The mission commander noted a 7 nm difference in the computer position and the VOR position.

We arrived at our *on station* point as planned, and I chopped tactical with the local center as we descended to the 5000-foot *on station* altitude. As luck would have it, this altitude put us smack in the middle of some very unpleasant weather. It was now takeoff plus 1 hour, and I was still unable to obtain an accurate outside fix. There was still time to get a couple of radar fixes before the landmass was beyond our radar range, but the operator was having stabilization problems with the radar and was unable to get a clear landmass identification. One by one, the possible outside fixing sources were eliminated. LORAN and celestial were unusable because of weather. Radar, ADF, VOR, and TACAN were down because of gear problems. At this point, I began to feel a little squirmy. I informed the mission commander of the problem, but maintained that it was not serious. An abort was considered, but not initiated. With the two inertial positions still tracking on top of each other, they appeared to be giving accurate information. This helped relieve some of the anxiety. I was still concerned, however, with their drift at takeoff, but the flight continued on.

One and a half hours into the mission, the inertial readouts split and the decision was made to abort. An orbit fly-to point was established, and an attempt to obtain an inbound IFR clearance from Center was initiated with negative results. In an effort to alleviate this problem, a slow spiralling climb was begun. We were now 2 hours into the flight. Working frantically to obtain our position, I attempted a LORAN fix. The fix put the aircraft 130 miles from where the computer had us. This sent sheer panic through my mind, because 130 miles off course would put us over a landmass in the vicinity of 14,000-foot mountain peaks. Unsure of the LORAN fix accuracy, I queried the radar operator, but received no reply. Upon checking the radar console, I found one sound asleep radar operator and land returns directly below the aircraft! I nearly jumped out of my skin and resisted the urge to reprimand the radar operator at that moment. The flight station was immediately informed of our position, and communications were finally established with Center. By this time, the *Orion* had reached FL170 and was clear of any mountains. We will never know how close we came to hitting one! We continued on a course home and made an

uneventful recovery at homeplate.

Some very valuable lessons learned can be gained by analysis of this near-disaster. Foremost is: **Communicate.** Mission success and crew safety depend upon crew coordination. This coordination is possible only through continuous and accurate communication. I was in error by not communicating my problems early on, and continued to be in error by minimizing their seriousness. Navigators are sometimes a forgotten and taken-for-granted entity. Their job is seldom commended and is sometimes only recognized in cases of gross error. As a result, many navigators have a reluctance to admit they are having problems, much less admit they are lost. As a member of a flightcrew, you have an obligation both morally and professionally to keep that crew informed of any problems you may be having.

The second lesson learned is: **Don't be too eager to accept internally generated positional data as gospel.** Reliance on inertials can lead you down the path. And, if you are not careful, you may not have a chance to recover. Be a systems navigator, use everything at your disposal, practice your basic nav skills, and be prepared for the day when this may happen to you. If it hasn't happened yet, it may!

Lastly, publicly flog any sleeping radar operator!

How much is enough?

Relationships Between Carrier Landing Performance and Flight Experience

By Dr. Michael S. Borowsky
LCDR Art Beck
Dr. John A. Gaynor
Ms. Gloria B. Barrett
Naval Safety Center
with
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VA-37

HOW much is enough? When it comes to exposing oneself to the back end of the boat, this becomes a very pertinent question. The goal is to develop proficiency and then maintain it. Now, most all pilots will agree the only way to maintain proficiency is to fly all the time. Unfortunately, money and operating schedules prohibit this. So, with an eye toward safety, qualification criteria have been established and aircrews are continually monitored to ensure currency. Still, we have carrier landing accidents that are attributed to pilot error. The question arises as to how these accidents relate to the experience of the pilots involved. Presumably, the answer to this question would aid in revising the criteria, or at least identify these individual experience levels which should receive more careful attention.

To this end, the Naval Safety Center and Attack Squadron THIRTY-SEVEN (VA-37) completed comprehensive independent studies designed specifically to determine what relationships exist between carrier landing performance and carrier landing experience.

The Naval Safety Center studied the fighter and attack communities, correlating accident rates to experience during the last 7, 30, 365 days, and lifetime. The analysis conducted by VA-37 related first night pass LSO grades with the number of recent carrier landings.

The relationships indicated by both studies are mutually supporting. Two basic conclusions, which substantiate already perceived truths, can be drawn:

- As total lifetime carrier landing experience increases, the accident potential decreases.
- Carrier landing proficiency, both day and night, for experienced (i.e., over 100 arrested landings) as well as inexperienced aviators is degraded if recent carrier landing experience is low.

ATTACK ANALYSIS. Studies were based on analysis of 26 total attack accidents, including 14 night accidents, in which the pilot was listed as a causal factor. Significant causal factors included lack of headwork, slow response to visual aids and LSO, and development of high sink rate. Additional factors involved were black night/no horizon, pitching deck, airborne emergency, and failure of LSO to initiate a timely waveoff. Generally, however, it appears that the pilots involved in the night accidents were "behind the power curve" and couldn't cope with the situations.

It was evident that the highest potential for an accident exists for the pilots with less than 100 total carrier landings and/or 50 night landings. For both experienced and inexperienced pilots, areas where accident potential was highest relative to lack of recent experience were apparent. In considering total traps within a time period, the significant areas were: less than seven traps in the previous 7 days; less than 15 traps in the previous 30 days; and between 20 and 50 traps in the previous year. When considering night arrestments alone, the significant areas were: less than three night traps in the past 7 days; less than five in the last 30 days; and less than 20 in the past year.

FIGHTER ANALYSIS. Thirty-five fighter, CV landing accidents, including 20 night accidents, were studied here. These accidents were generally directly related to glide slope control. The pilot errors involved can be defined as: overreaction and subsequent overcontrol of corrections on the glide slope, resulting in a "sine wave" approach; slow response to carrier landing aids, including the LSO; and not getting sufficient rest prior to flight (i.e., fatigue). In some cases, there were several factors which placed additional demands on the pilot and affected his performance. These included pitching decks, bad weather, and dark night/no horizon. Another significant factor dealt with the LSO failing to give adequate and/or timely calls and signals.

In the fighter community, the accident rate was highest for those pilots with less than 100 total and/or 20 night traps. Again, looking at both the experienced and inexperienced pilots, significant areas were identifiable where the accident rate was highest relative to recent experience. Regarding total traps, those with between 5 and 6 in the last 7 days stand out. (In the 30- and 365-day breakdown, there was no significant difference in the categories considered – all were high.) Considering night traps only, the standouts were: those pilots with one to four night traps in the last 7 days; less than two night traps in the last 30 days (although it must be noted that the night rates are high across the board); and between 10 and 19 night traps in the past year.

ALL CARRIER AIRCRAFT, NIGHT PASS ANALYSIS. Inexperienced aviators (less than 100 carrier landings) exhibited a significantly higher proportion (approximately double) of unacceptable first pass, night carrier approaches/landings than experienced aviators. For both categories, the number of unacceptable passes decreased if at least two night landings were performed in the previous 7 days and at least three in the previous 14 days. Previous 30-day trends appear to be random. Also, recent day carrier landing experience appeared to have less influence than night landings on the quality of night carrier landing performance. The significant groups here were the inexperienced pilot and any pilot with less than two night landings in the last 7 days or three night landings in the last 14 days.

THE BOTTOM LINE. Statistical analysis has provided insight which should be used in determining *how much is enough*. Pilots should categorize themselves and, if they fall within an area of concern, take heed. (This doesn't mean relax once you get over the hump!) Commanding officers and schedules officers should take the above into account when deciding whether to send the aviator flying, particularly if other taxing factors (black night, pitching deck, weather, fatigue, etc.) are present. Operations planners should provide enough time at sea and schedule sorties to get the crews over the hump and keep them proficient. (Admittedly, a difficult task considering the constraints, but necessary if the pilot factor carrier landing accident rate is to be reduced.)

Finally, to the LSOs – you can make the difference! You are the last chance. If you're not totally satisfied with the approach, send him around in time.

The data used to conduct these analyses are available from Naval Safety Center (Code 60) upon request. –Ed.

A

smooth job

ON 31 October, 1979, at 1500 local, while providing airborne alert services, the SAR crew at NAS Patuxent River was conducting practice doppler rescue approaches over the Chesapeake Bay, approximately 15 miles south of the Naval Air Station.

The aircraft commander, LCDR Bob Sloan, had completed two approaches and turned over the controls to the copilot, Capt Dan Price, USMC, for the third approach. As the helicopter reached the bottom of the approach and was being trimmed out for a 50-foot hover, the No. 2 engine experienced a sudden and complete power loss, later determined to be the result of a failure in the engine-driven fuel pump. The heavy, SAR-mission-configured HH-46A was above single-engine weight and quickly settled into the water.

During the seconds prior to water entry, LCDR Sloan took command of the aircraft and prepared for a water landing. Capt Price started the auxiliary powerplant and switched to the emergency UHF antenna. The crew, consisting of crew chief AT2 Thomas Carpenter and swimmer ADAN Mark Gallagher, quickly ensured watertight integrity and readied emergency equipment.

Due to the aircraft's weight and the proximity of the helicopter to the beach line, about 3 miles away, LCDR Sloan made the decision to water taxi to the beach. En route, several engine restart attempts were made without success, and the Mayday report was made. As the helicopter approached the beach, LCDR Sloan activated the emergency throttle to get maximum power from the No. 1 engine and taxied the helicopter as far as possible up the beach. Normal shutdown followed, and the crew safely exited the aircraft.

Meanwhile, command personnel at the Naval Air Station were quickly formulating a plan to retrieve the helicopter from the remote beach area. Liaison with the Marines at MCAS Quantico, Army units at Fort Eustis, and Navy authorities in Norfolk produced the necessary ingredients for a successful extraction of the craft the following morning. The helicopter was safely returned to the Naval Air Station approximately 22 hours after the incident occurred.

Throughout the entire evolution, the knowledge, preparation, dedication, judgment, and skill exhibited by the flightcrew and those involved in the joint salvage effort paid off. A safely returned flightcrew and the successful extraction of an undamaged craft were the results. Well done to all concerned!

SURVIVAL/POSTEJECTION PROCEDURES

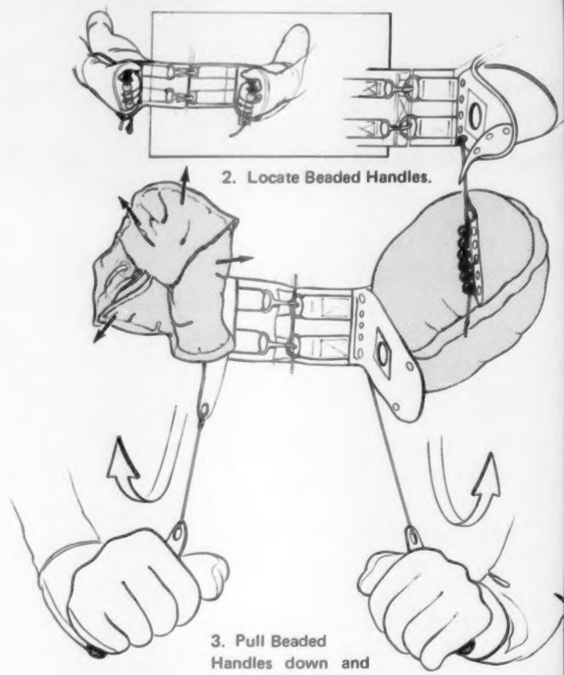
Integrated MA-2 Torso Harness with Rigid Seat Survival Kit – LPA Inflation and Liferaft Deployment Sequence A-4, TA-4, A-7, TA-7, and S-3 Configuration (no G-suit for S-3 crews).

By CDR Jack Greear, MSC
Aviation Physiology Training Unit
NAS Norfolk, VA

THE following scenario describes step-by-step diagrams and procedures for inflation of the Life Preserver Assembly (LPA) configured with beaded handles and the 35-gram CO_2 cylinder and utilizing the RSSK-8 with either ACC-352 or ACC-377. The emergency egress situation is a below barostat, high-altitude ejection, over water in which seat/man separation and parachute deployment have been accomplished automatically.

These techniques are being published in advance of NAVAIR-00-80T-101 for two important reasons: first, so they will get to the fleet as soon as possible; and second, so that the project manager may receive any possible feedback on these procedures before NAVAIR-00-80T-101 is finally printed. Please forward any comments to: Commanding Officer, Naval Regional Medical Center (Code APTU-230), Portsmouth, VA 23708.

1. Immediately following opening shock of parachute, check the condition of the parachute canopy. If no malfunctions have occurred, proceed to next step.



2. Locate Beaded Handles.

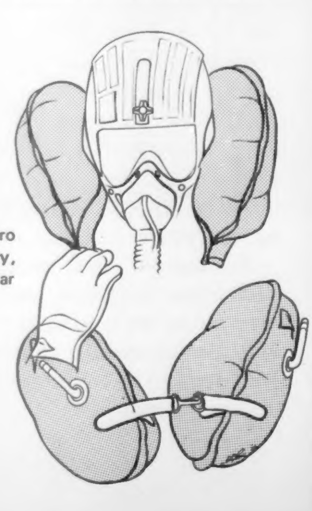
3. Pull Beaded Handles down and out to inflate LPA.

4. Remove chafing material (when required).

5. Snap LPA waist lobes together.

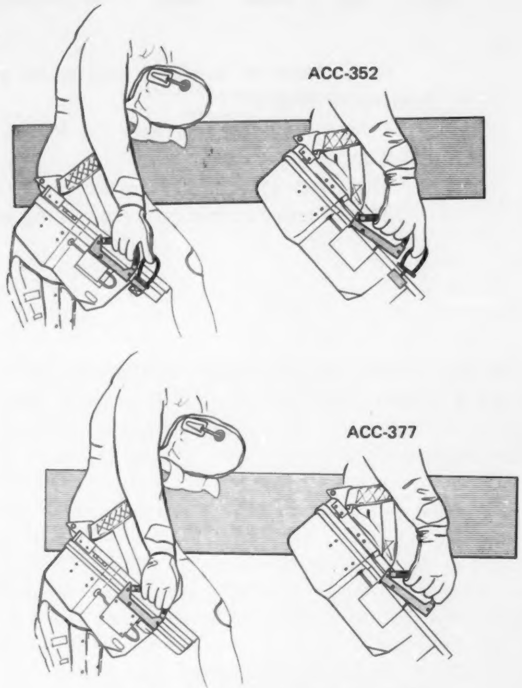
6. Squeeze LPA waist lobes together to help release Velcro on collar lobe, or

6A. Manually release Velcro on collar, if necessary, to achieve complete collar lobe inflation.

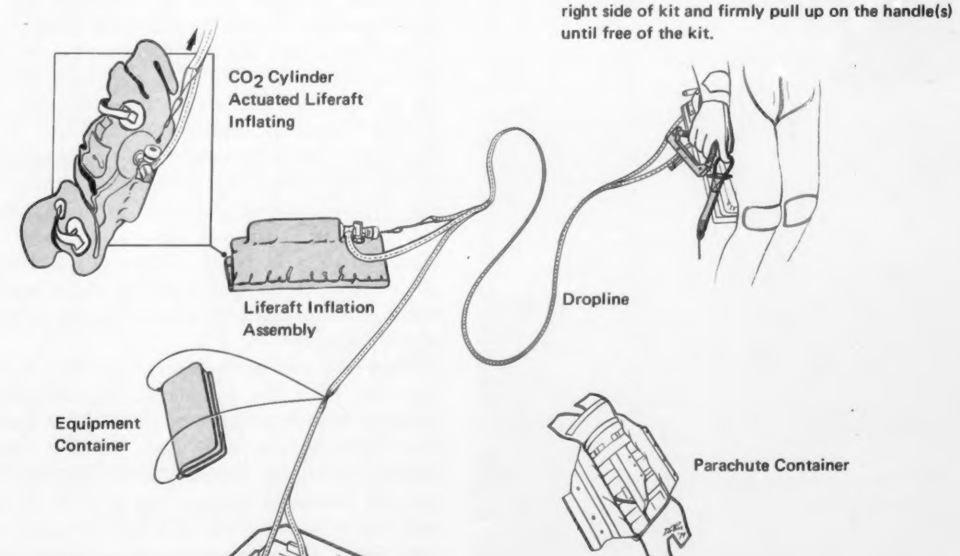


NATOPS Evaluator for ESCAPAC LSE is LCDR Bason, MSC

7. Aircrewman under canopy with LPA inflated preparing to activate raft release handle.



8. With the right hand, locate the two handles (ACC-352) or single handle (ACC-377) on the right side of kit and firmly pull up on the handle(s) until free of the kit.



9. Actuation of the raft release handle(s) unlocks the RSSK, allowing the parachute container to fall free while the lower part of the RSSK, attached by a dropline, falls its full length and automatically inflates the liferaft.

Helicopters and humidity -

"An increase in humidity will cause a slight reduction of power [available], but not to any noticeable extent."

"A high humidity increases the density altitude and [effectively] reduces the efficiency of the rotor system."

"The effect of humidity on gas turbine engines is negligible."

"The effect of humidity is considered negligible in this helicopter."

BREAK out your NATOPS manual and let's have a look at the effects of humidity on your bird. Right near the start of Chapter 3 you'll probably find one of the statements above concerning the effects on helicopter performance. While some of these comments cause you to sweat a little more than others, if they are taken as a whole, you get the impression that, when you are flying a modern, turbine-powered helicopter, humidity is no big thing. Is it so?

Now let's turn to Chapter 11 and look up the definition of standard atmosphere. The standard atmosphere, which is the basis for the data presented in NATOPS, defines characteristics of air as a function of pressure altitude and provides a reference from which performance can be evaluated. That's not to say that we always assume standard atmospheric conditions. NATOPS gives us the means, for instance, to correct pressure altitude for nonstandard temperature in order to compute density altitude. But when we use the conversion chart provided in NATOPS for this computation (see Fig. 1), we are assuming that temperature is the only thing causing pressure altitude and density altitude to differ. In other words, that chart assumes otherwise standard atmospheric properties. As you have seen in the definition of standard atmosphere, one of these assumed properties is that the air is *dry*. Thus, NATOPS doesn't presently allow us to figure the effects of humidity on performance. While this is consistent with the gist of most of the quotes printed at the beginning of this article, just how big is the error introduced by the assumption of zero humidity?

When did you last deploy to the Med or to Cubi? Did you ever see a dry day there? High humidity conditions common to such places cause air to be less dense for a given temperature because water vapor, which is about 38 percent lighter than dry air, displaces dry air, resulting in a lower mass per unit volume of mixture (just as a mix of ping pong and golf balls would have less mass than the same volume of golf balls alone). The end result is reduced density and thus higher density altitude. Now the question: "How much higher?"

NO SWEAT?!

By Maj J. P. Cress, USMC
Naval Postgraduate School
Monterey, CA

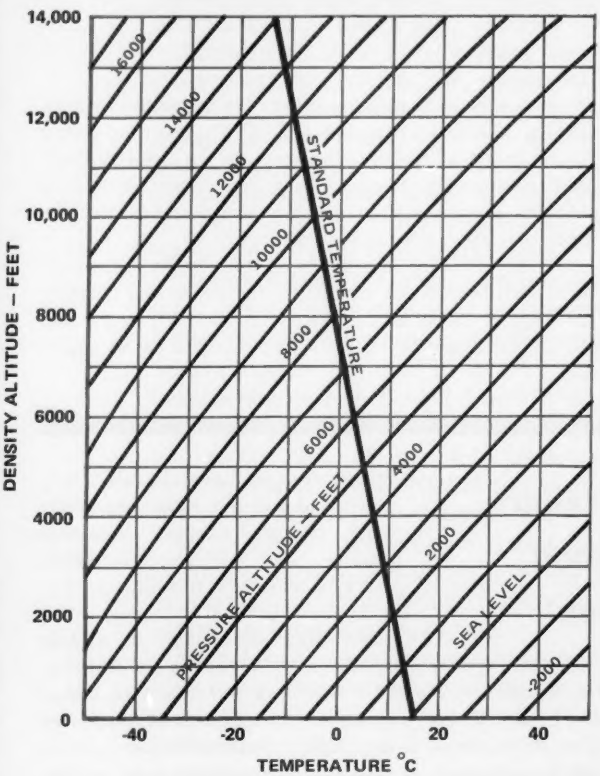


Fig. 1. Density Altitude Chart

An article entitled "It's Not the Humidity – It's the Heat," which appeared recently in an Aircraft Owners and Pilots Association publication, leads to the conclusion that for each 10 percent increase in relative humidity, the density altitude increases approximately 100 feet. Thus, if you go to NATOPS (which, again, assumes that air is always dry) and determine the density altitude while planning a troop lift, cargo pickup, VERTREP, dip, or whatever around Cubi Point or another place like it, depending on relative humidity, you might start out with a built-in error of as much as 1000 feet in your density altitude calculation.

To put this in perspective, let's look at the H-53. Specifically, look back on the article entitled "Deadly External Lift" in the MAY '79 APPROACH. There we had a retrograde operation from a landing zone at a dry density altitude of 3600 feet with a CH-53D at 39,300 pounds gross weight. According to NATOPS, sufficient power (at the maximum engine rating) was barely available to hover out of ground effect with this weight at the computed density altitude of 3600 feet. But let's suppose the relative humidity was not zero, as assumed, but rather something closer to 100 percent, in which case the real density altitude is more like 4600 feet. In this situation, the engines would deliver 2 percent less power, and power required to hover out of ground effect (HOGE) at 39,300 pounds would increase by about 2 percent. To put it another way, the manual indicates an ability to hover out of ground effect at 39,300 pounds when the air is assumed dry, but shows maximum HOGE gross weight to be 38,300 pounds when the effects of 100 percent humidity are taken into account. That amounts to nearly a 9 percent difference in payload – hardly negligible! It appears reasonable to conclude that, if the crew had taken into account the effects of humidity on aircraft performance and taken necessary corrective action, this aircraft might have been saved.

If the foregoing example has made a believer of you, your next question is this: "How do I figure what the relative

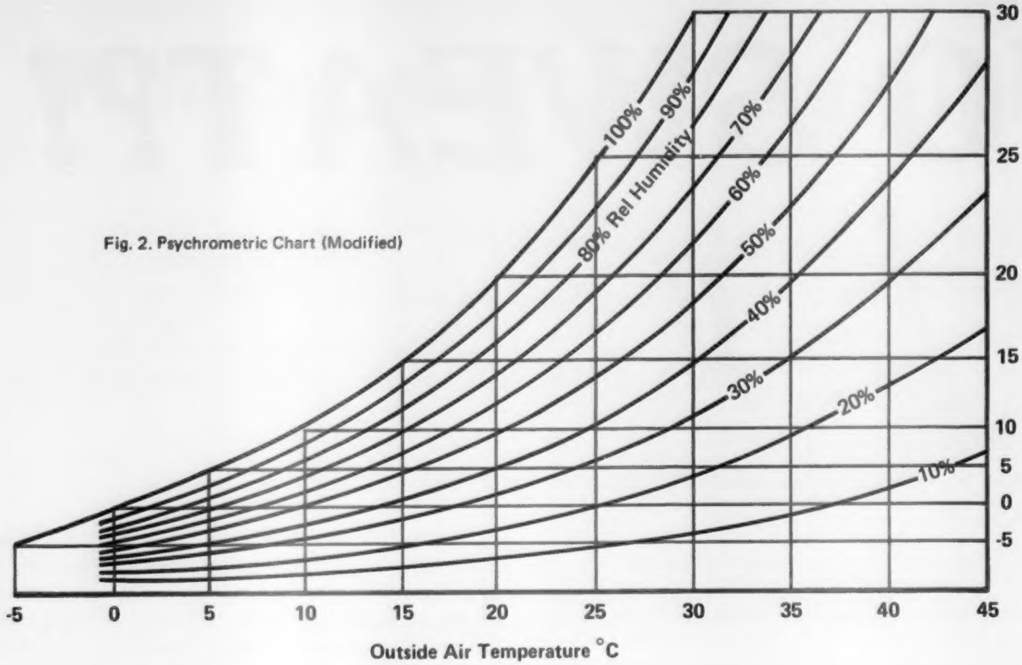


Fig. 2. Psychrometric Chart (Modified)

humidity is so that I can adjust the density altitude for moisture?" While rummaging through an old H-34 manual recently, I found something called a psychrometric chart which seems to make that almost too easy. A simplified psychrometric chart is shown in Fig. 2. Note that if you go into this chart with a dewpoint and an outside air temperature (OAT), you can read relative humidity directly. Where do you get these? The OAT is, of course, available in the cockpit, and you'll have to depend on the *weather guesser* to provide you with the dewpoint temperature for the area and time period in which you plan to operate. Try an example with an OAT of 30°C and a dewpoint of 28°C. The chart indicates a relative humidity of about 88 percent. In this case you would need to adjust the density altitude (determined from your NATOPS conversion chart) upward by 880 feet in order to properly compute aircraft performance.

Are the effects of humidity negligible or hardly noticeable? We've seen at least one case where the answer was certainly no! Check it out before you make your next lift in hot, humid air. If you figure in the moisture, it should be *no sweat!*

Hydraulic failure... *and a good decision*

DURING execution of a prebriefed bingo procedure from a TRANSPAC, LT Fred Moore and Maj J. J. Kratz experienced a utility hydraulic failure in their F-4J some 300 miles from the nearest landing field. The bingo profile back to MCAS Kaneohe was still appropriate until the pneumatic pressure began to decrease. Now faced with the decision of either possibly not being able to get the landing gear down at Kaneohe, or pneumatically extending the gear in mid-Pacific and facing a landing at a field with no arresting gear, the crew chose the latter course.

This decision required rapid action and precise knowledge of all the consequences. The crew felt the odds were better in landing at Hilo, Hawaii, even though it lacked arresting gear; they diverted to Hilo and landed successfully using manually applied pneumatic braking with differential residual hydraulic braking for steering.

This emergency (i.e., landing with a utility hydraulic failure at a field without arresting gear) is one feared by all F-4 aircrew and should be looked upon with interest and admiration by all. Cool headwork and smooth execution of procedures saved another aircraft and crew.

In Memoriam

Mr. George F. Stewart, Head of the Systems Safety Engineering Branch at the Naval Safety Center, passed away on Tuesday, June 24, 1980. He was a native of Winston-Salem, North Carolina and received his degree in aeronautical engineering from Virginia Polytechnic Institute in 1960.

During his 12 years at the Naval Safety Center, he was instrumental in developing the concept of system safety engineering, particularly as applicable to the Navy's procurement of new production aircraft. Mr. Stewart worked closely with the system safety engineering staffs of the prime contractors for the F-14, S-3, F-18, and E-2 aircraft. Additionally, he was involved in system safety for the Phoenix, Cruise, and AIM-9L missiles, for the F-401 and F-404 engines, and for the Air Combat Maneuvering Range, LAMPS, and ULAIDS programs.

One of the analytical studies undertaken by Mr. Stewart was an analysis of Navy and Air Force data on bleed air system failures. The analysis indicated a need for complete redesign of such a system in new aircraft. It precipitated the requirement for bleed air warning systems, shutoff valves, and shrouded ducts in new aircraft (F-14, S-3, and F-18).

He made two detailed studies for CNO on the advisability of extending the service life of the F-9 training aircraft. As a result of the recommendations from these studies, a decision was made to retire the F-9 aircraft and buy a new training aircraft.

Mr. Stewart was a member of many advisory boards concerning service life extensions for numerous aircraft. He was on the Board of Directors for the International Systems Safety Society, a group which influences civilian industry to develop safer products.

He helped to develop the outline for a master's level Systems Safety Engineering course to be added to the master's degree curriculum in aeronautical engineering at the Naval Postgraduate School in Monterey, California.

His untiring efforts on behalf of those who use and rely on aviation weapons systems will be sorely missed. The results of his work will continue, however, and the lives saved due to his pioneering efforts will be his epitaph.

LETTERS

to the editor

An Author Responds

NAS Moffett Field – I wrote the article "Hours of Boredom . . .?" printed in the MAR '80 issue of APPROACH. In the JUN '80 Letters to the Editor section, LCDR H. R. Freeman critically commented upon my handling of the incident that was discussed in the article. I would like to respond by first saying that my intention in writing the article was to relate an interesting and somewhat unusual incident and to tell an entertaining yet factual "sea story." While I wanted to recount the major points of the incident, I did not feel it necessary to mention every single consideration in the headwork process.

In order to clarify any doubts that may exist, I would like to say that my decision to divert to the alternate an hour and a half away was based on the fact that it was the most suitable alternate for a possible gear-up landing, and fuel would have become critical had I remained near Homeplate to trouble-shoot and then had to divert. I did have another alternate that was VFR and only 20 minutes away (with a 70-knot tailwind). While it was not suitable for the gear problem I had, I knew that if I could get the gear down I could use it. In the article, I wrote (once the gear was down), ". . . Reassessing the position of the air station, fuel state, and after a quick check on the weather, we decided to return to Homeplate for a final landing." To explain this, detail by detail: I was in direct contact with my CO in the tower (a PPC), and I knew the field was not socked in. Even if it had been, I had sufficient fuel to shoot several approaches and still proceed to the closer alternate with VFR weather.

To those persons who felt there were not enough details in my article, I apologize. However, after 8 years and 2,500 hours in naval aviation, I believe I do have some understanding of the beginning paragraph in NATOPS that starts with the title of *Scope*.

LT Martin R. Hill
VP-31

Another Author Responds

Monterey, CA – A letter to the editor which appeared in the MAY '80 issue of APPROACH indicated a Patuxent River reader's disagreement with some points made in the NOV '79 APPROACH article titled "Guzzle Not!" Readers who wish to resolve some of the disagreements will find some answers on page 121 of "Aerodynamics for Naval Aviators" (NAVAIR 00-80T-80), where specific fuel consumption versus temperature is discussed.

The same letter seems to indicate that external stores/loads have usually negligible effects on range, range speed, and endurance. While few would disagree that nice aerodynamic shapes like *MAD birds* hurt less than others, it all hurts. Consider an H-46, for instance, with a 6 by 6 box in a net on the hook. This not-so-uncommon loading reduces range (at 100 KIAS) by nearly 30 percent. A helo jockey flying a mission demanding the most from his tank of fuel certainly can't afford a 30 percent error in range. In some situations he can't afford to neglect the 3½ percent reduction imposed by a *MAD bird* and smoke launcher either.

Maj J. P. Cress, USMC
Author of "Guzzle Not!"

Double-barreled Barb

MCAS Futenma, Okinawa – I enjoyed "Ready for Ferry?" by LT Steve Duffy in your May issue. However, I think the article begged the issue raised by the title. A more appropriate title for the contents of the article would have been "Ready for Ferry by the Ferry Squadron?," or better yet, "Does the Navy Need a Ferry Squadron?"

Many of the points made tend to support the position that the ferry squadron has outlived its usefulness. LT Duffy listed some accident statistics but did not address VRF-31 accidents specifically (which I think he should have, considering the nature of the article). I don't know the number of ferry squadron accidents, but I do feel that many of those which have occurred would not have occurred if the pilots understood the aircraft.

The JUN '80 article "Is It Worth It?" was truly outstanding. However, the editorial comment at the end was not only out of place – it was unnecessary. It is a "black hat" comment that tends to defeat open communications. The saddest part is that many people may read the editorial comment because it is in italics and miss the gist of the entire article.

Maj N. L. McCall, USMC
Executive Officer
H&MS-36

DRIVE CAREFULLY. . .

LABOR DAY SEPT. 1ST

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, Naval Safety Center, NAS Norfolk, VA 23511. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

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Some replacement parts don't work.

Use your visor

when the situation calls for it!

Naval Safety Center
NAS Norfolk, Virginia

On a collision course
DEAD AHEAD
is just that.

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NAS Norfolk, Virginia

Poster idea contributed by LCDR Jay Tyler, VAQ-138 Yellowjacket Safety Officer.